Fuji Electric
Innovating Energy Technology

Starting Guide
FRENIC-MEGA

Model FRN□□□G1E-4ELF

Customized solution for elevators

SG_MEGA_ELF_EN_1.3.0

Version	Changes applied	Date	Written	Checked	Approved
0.0.1	Draft	30.10.2010	J. Alonso		
0.0.2	Small text corrections	21.12.2010	D. Bedford		
1.0.0	1st version Small text corrections Small figure corrections Information about P09 and P11 is added	22.12.2010	J. Alonso	D. Bedford	D. Bedford
1.0.1	Terminal X8 is changed by Y3 in Chapter 1. Numbers of page in Contents has been corrected.	22.12.2010	J. Alonso	D. Bedford	D. Bedford
1.1.0	Chapter 3.4 is added. Explanation of E16 adjustment is modified. Setting of J95 is changed.	24.03.2011	J. Alonso	D. Bedford	D. Bedford
1.1.1	H96 included on chapter 7.	24.08.2011	J. Alonso		
1.2.0	Terminal EN1 and EN2 are added. d25 is included in default setting. Table 1 is modified. Alarm messages table modified.	29.12.2011	J. Alonso		
1.3.0	Updating to inverter -4ELF version SW Rom 3703 (see “SI27-5471i” for details)	04.05.2013	S.Gentiluomo	J. Alonso	J. Català

Contents

0. About this manual

Thank you very much for choosing FRENIC-MEGA inverter.

This product is designed to drive a three-phase induction motor in open or closed loop (using encoder or not). Read throughout this manual and be familiar with correct handling and operation of this product.

Deliver this “guide to usage” to the end user of this product. Keep this “guide to usage” in a safe place until this product is discarded.

Improper handling may result in incorrect operation, a short life, or even a failure of this product as well as the motor.

Listed below are the other manuals related to the use of the FRENIC-MEGA. Read them in conjunction with this manual if necessary.
• FRENIC-MEGA User's Manual (MEH278b)
• FRENIC-MEGA Instruction Manual (INR-SI47-1223b-E)
• FRENIC-MEGA Specification (SI27-5471i)

The manuals are subject to change without notice. Be sure to obtain the latest editions for use.

Note This “guide to usage” is based on inverter FRENIC-MEGA ELF specification. It corresponds to firmware version 3703 or later. For other software versions, please contact with Fuji Electric technical department.

1. Control, braking resistor and rescue operation connection set up

1.1 Power terminals and options connection

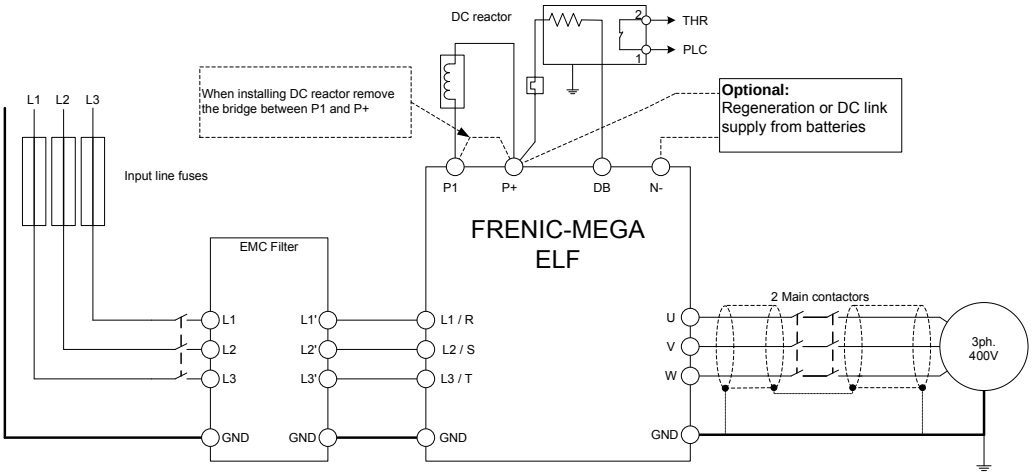

Figure 1. Power terminals and options connection

1.2 Control terminals connection

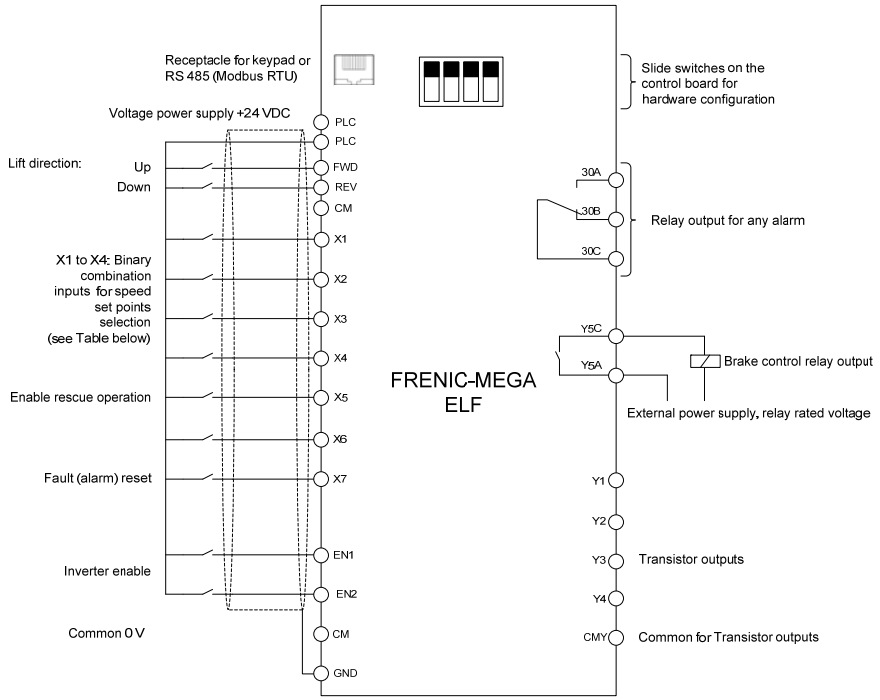

Figure 2. Control terminals connection

1.3 Batteries and UPS connection for rescue operation

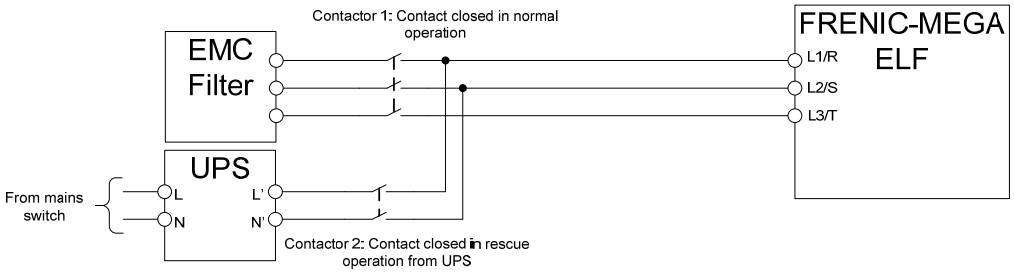

Figure 3. Batteries and UPS connection for rescue operation

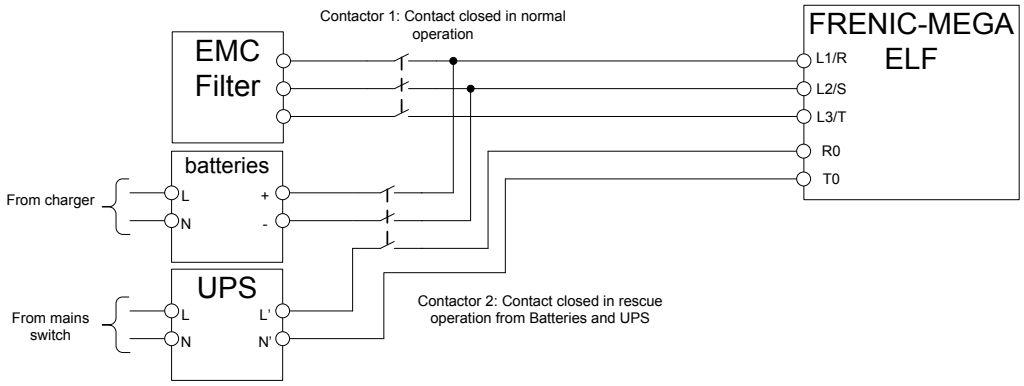

Figure 4. UPS connection for rescue operation

2. Encoder connection

In case of using any type of feedback (encoder) a basic setting may be needed, this setting is shown in table 1:

Table 1. Specific setting when using encoder

Parameter	Name	Setting [*1]	
		TP-G1-J1 (Decimal)	TP-E1U (Hexadecimal)
d15	Encoder pulse resolution	512	200
		1024	400
		2048	800

[*1] Encoder pulses are visualized using different numeric systems depending on the keypad. On table 1 most common encoder pulses are shown. Of course, pulses depend on encoder's specifications.

Encoder board (OPC-G1-PG or PG2) can be only connected to port C as is shown in figure 5.

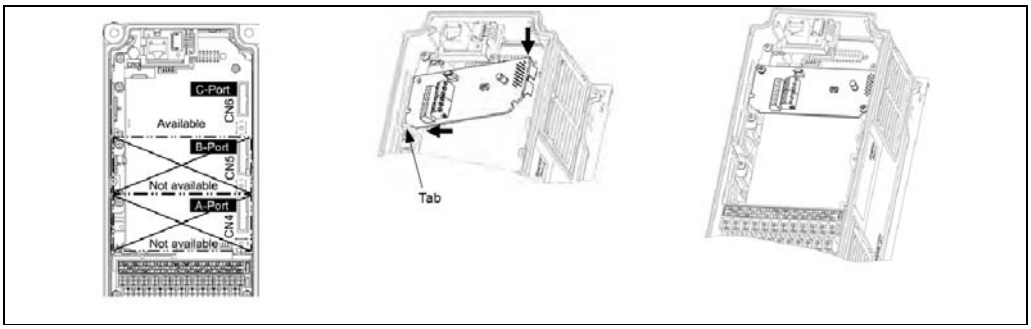

Figure 5. Available port and option board installation

2.1 Option board OPC-G1-PG

Option board OPC-G1-PG is the specific board for connecting a HTL standard encoder (standard power supply voltage range between 10~30 VDC). The encoder connected must fulfil the technical requirements specified in table 2.

Table 2. HTL encoder technical requirements

Property	Specification	
Encoder's required supply [*1]	+12VDC ±10%, 120mA (SW1=12V) +15VDC ±10%, 120mA (SW1=15V)	
Option board input pulses threshold	High level ≥ 8VDC, Low level ≤ 3VDC (SW1=12V) High level ≥ 10VDC, Low level ≤ 3VDC (SW1=15V)	
Output signal	Open Collector	Push pull (complementary)
Maximum input frequency	30kHz	100kHz
Maximum cable length	20m	100m
Encoder pulses resolution	20 to 3000 pulses/rev (recommended 1024 pulses/rev)	

[*1] In case of different supply voltage is required, please use an external power supply.

For wiring this encoder type to OPC-G1-PG, see figure 6 and table 3 below.

Table 3. Option terminals and encoder signals

Signal	Option terminal	Meaning
+VCC	PO	Power supply
A phase	YA	Pulses phase A
B phase	YB	Pulses phase B 90º shifted
0VCC	CM	Common 0V

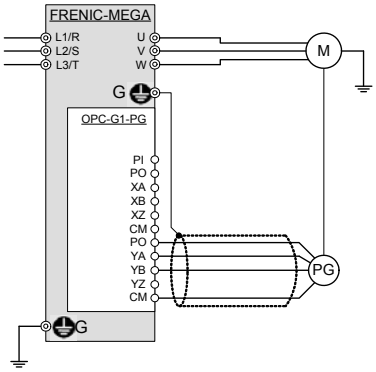

Figure 6. Encoder's connection

2.2 Option board OPC-G1-PG2

Option board OPC-G1-PG2 is the specific board for connecting a Line Driver standard encoder (differential signal +5VDC). The encoder connected must fulfil the technical requirements specified in table 4.

Table 4. Line Driver encoder technical requirements

Property	Specification
Encoder's required supply *1	+5VDC ±10%, 200mA
Output signal	Line Driver
Maximum input frequency	100kHz
Maximum cable length	100m
Encoder pulses resolution	20 to 3000 pulses/rev (recommended 1024 pulses/rev)

*1 In case of different supply voltage is required, please use an external power supply.

For wiring this encoder type to OPC-G1-PG2, see figure 7 and table 5 below.

Table 5. Option terminals and encoder signals

Signal	Option terminal	Meaning
+ VCC	PO	Power supply
A phase	YA	Pulses phase A
/A phase	*YA	Pulses phase A inverted
B phase	YB	Pulses phase B 90º shifted
/B phase	*YB	Pulses phase B inverted 90º shifted
0 VCC	CM	Common 0V

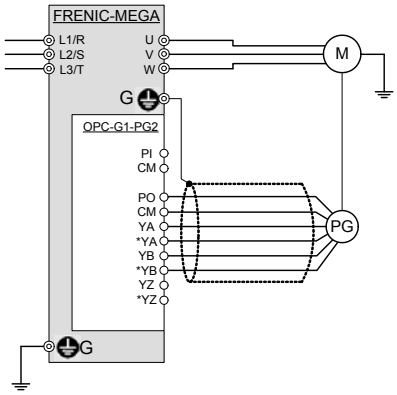

Figure 7. Encoder's connection

3. Keypad operation

3.1 LED monitor, keys and LED indicators on the keypad

As shown on figure 8, the keypad consists of a four-digit LED monitor, six keys, and five LED indicators. The keypad allows you to run and stop the motor, monitor the running status, specify the function code data, and monitor I/O signal states, maintenance information, and alarm information. The meaning of each part of the keypad is explained on table 6.

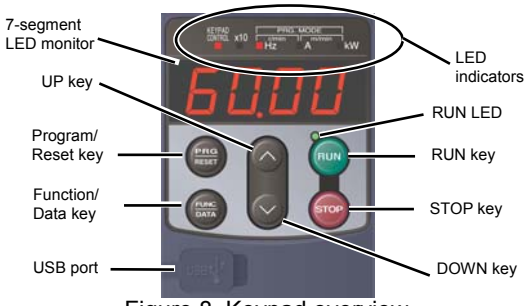

Figure 8. Keypad overview

Table 6. Overview of Keypad Functions

Item	LED Monitor, Keys, and LED Indicators	Functions
LED Monitor		Four-digit, 7-segment LED monitor which displays the followings according to the operation modes. ■ In Running mode: Running status information (e.g., output frequency, current, and voltage) When a light alarm occurs, L-AL is displayed. ■ In Programming mode: Menus, function codes and their data ■ In Alarm mode: Alarm code, which identifies the alarm factor when the protective function is activated.
Operation Keys	PRG RESET	Program/Reset key which switches the operation modes of the inverter. ■ In Running mode: Pressing this key switches the inverter to Programming mode. ■ In Programming mode: Pressing this key switches the inverter to Running mode. ■ In Alarm mode: Pressing this key after removing the alarm factor will switch the inverter to Running mode.
	FUNC DATA	Function/Data key which switches the operations you want to do in each mode as follows: ■ In Running mode: Pressing this key switches the information to be displayed concerning the status of the inverter (output frequency (Hz), output current (A), output voltage (V), etc.). When a light alarm is displayed, holding down this key resets the light alarm and switches back to Running mode. ■ In Programming mode: Pressing this key displays the function code or establishes the data entered with ∧ and ∨ keys. ■ In Alarm mode: Pressing this key displays the details of the problem indicated by the alarm code that has come up on the LED monitor.
	RUN	RUN key. Press this key to run the motor.
	STOP	STOP key. Press this key to stop the motor.
	∧/∨	UP and DOWN keys. Press these keys to select the setting items and change the function code data displayed on the LED monitor.
LED Indicators	RUN LED	Lights when running with a run command entered by the RUN key, by terminal command ***FWD*** or ***REV***, or through the communications link.
	KEYPAD CONTROL LED	Lights when the inverter is ready to run with a run command entered by the RUN key (F02 = 0, 2, or 3). In Programming and Alarm modes, however, pressing the RUN key cannot run the inverter even if this indicator lights.
	Unit LEDs (3 LEDs)	These three LED indicators identify the unit of numeral displayed on the LED monitor in Running mode by combination of lit and unlit states of them. Unit: Hz, A, kW, r/min and m/min Refer to the Instruction Manual, Chapter 3, Section 3.3.1 "Monitoring the running status" for details While the inverter is in Programming mode, the LEDs of Hz and kW light. ■ Hz □ A ■ kW
	X10 LED	Lights when the data to display exceeds 9999. When this LED lights, the "displayed value x 10" is the actual value. Example: If the LED monitor displays 1234 and the x10 LED lights, it means that the actual value is "1,234 × 10 = 12,340."
USB port		The USB port with a Mini-B connector enables the inverter to connect with a PC with an USB cable.

3.2 Overview of operation modes

FRENIC-MEGA keypad features the three operation modes shown in table 7.

Table 7. Keypad operation modes

Operation mode	Description
Running mode	After powered ON, the inverter automatically enters this mode. This mode allows you to specify the reference frequency, PID command value and etc., and run/stop the motor with the RUN / STOP keys. It is also possible to monitor the running status in real time. If a light alarm occurs, the L-AL appears on the LED monitor.
Programming mode	This mode allows you to configure function code data and check a variety of information relating to the inverter status and maintenance.
Alarm mode	If an alarm condition arises, the inverter automatically enters Alarm mode in which you can view the corresponding alarm code* and its related information on the LED monitor. * Alarm code: Indicates the cause of the alarm condition. For details, please refer to Chapter 8.

Figure 9 shows the status transition of the inverter between these three operation modes.

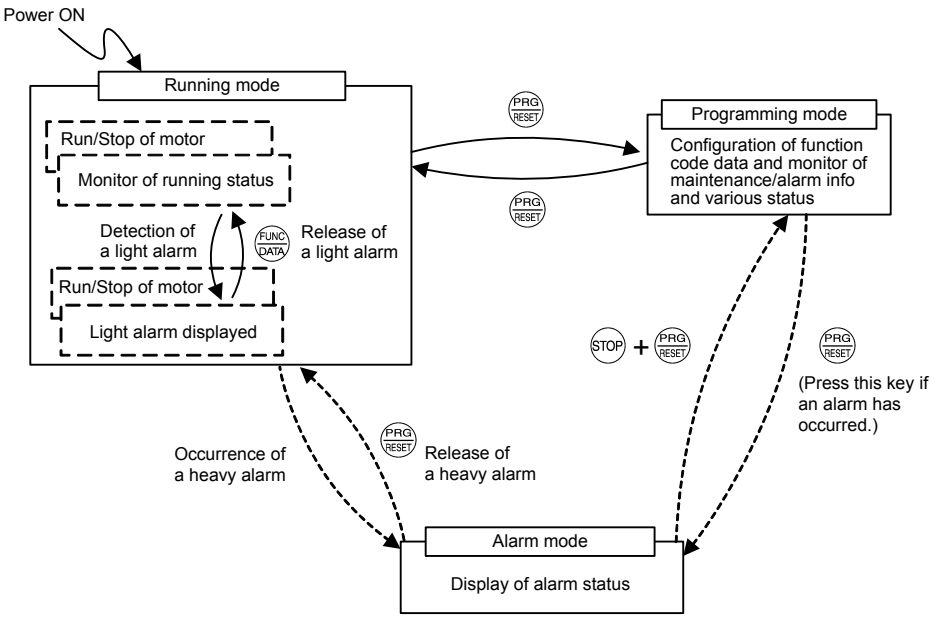

Figure 9. Status Transition between Operation Modes

Simultaneous keying

Simultaneous keying means pressing two keys at the same time. The simultaneous keying operation is expressed by a "+" letter between the keys throughout this manual.

For example, the expression "STOP + PRG RESET keys" stands for pressing the PRG RESET key with the STOP key held down.

3.3 USB connectivity

The keypad has an USB port (Mini-B connector) on its front. To connect an USB cable, open the USB port cover as shown below. The position of the USB port is shown in figure 10.

Figure 10. Position of USB port.

Connecting the inverter to a PC with an USB cable enables remote control from FRENIC Loader 3. On the PC running FRENIC Loader 3, it is possible to edit, check, manage, and monitor the function code data in real-time, to start or stop the inverter, and to monitor the running or alarm status of the inverter.

📖 For the instructions on how to use the FRENIC Loader 3, refer to the FRENIC Loader Instruction Manual.

In addition, using the keypad as a temporary storage media allows you to store the running status information in the keypad, detach the keypad from the inverter, and connect it to a PC running FRENIC Loader at an office or off-site place.

3.4 Keypad menus

Partial menu list can be accessed by pressing PRG RESET. In order to have all menus available, function E52 has to be set to 2 (E52=2 Full menu mode).

0. Quick Setup (0.Fnc)

Display only basic function codes to customize the inverters operation.

1. Data Setting (From 1.*F*_ _ to 1.*o*_ _)
Selecting each of these function codes enables its data to be displayed/changed.

2. Data Checking (*2.rEP*)
Display only function codes that have been changed from their factory defaults. You can refer to or change those function code data.

3. Drive Monitoring (*3.oPE*)
Displays the running information required for maintenance or test running.

4. I/O Checking (*4.I_o*)
Display external interface information.

Segments	LED 4	LED 3	LED 2	LED 1
a	30A/B/C	Y1-CMY	X7	FWD
b	---	Y2-CMY	---	REV
c	---	Y3-CMY	---	X1
d	---	Y4-CMY	EN1&2	X2
e	---	Y5A-Y5C	---	X3
f	---	---	(XF)*	X4
g	---	---	(XR)*	X5
dp	---	---	(RST)*	X6

Note If all terminal input signals are OFF (open), segment "g" on all of LED1 to LED4 will light ("– – – –").
(XF)*, (XR)*, (RST)* Only for communications.
This information can be monitored in 4_00 menu.

5. Maintenance Information (*5.CHE*)
Display maintenance information including cumulative run time.

6. Alarm information (*6.AL*)
Display the recent four alarm codes. You can refer to the running information at the time when the alarm occurred.

7. Data Copying (7.CPY)
Allows you to read or write function code data, as well as verifying it.

Example of Function setting
Example of function code data changing procedure, in that case F01 is setting from 0 to 2.

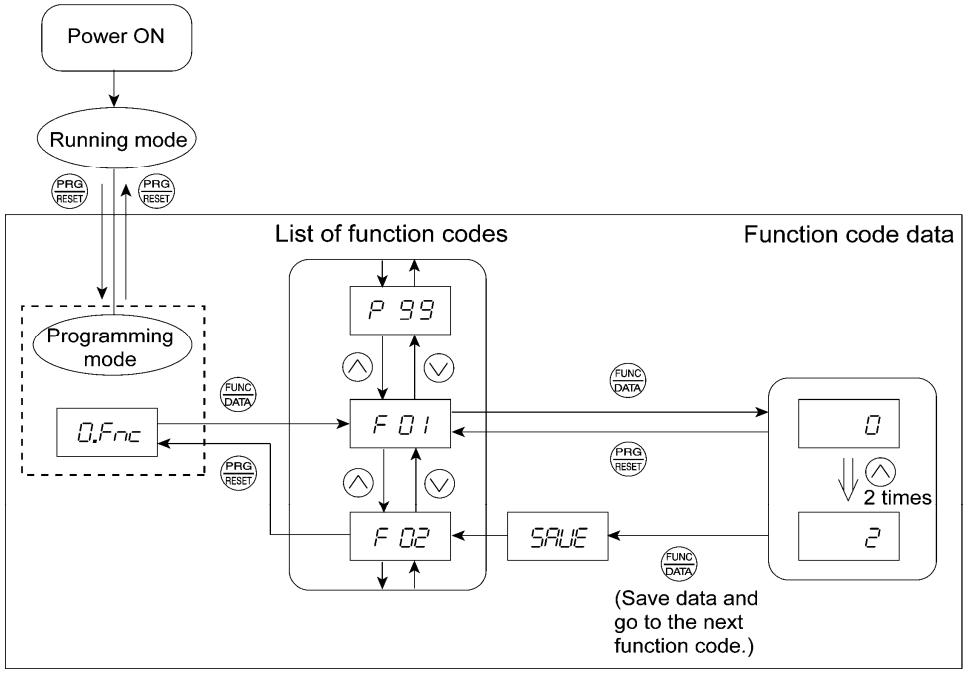

Figure 11. Function setting procedure

You can move the cursor when changing function code data by holding down the FUNC DATA key for 1 second or longer.

4. Motor commissioning

For induction motors (in open or closed loop) an auto tuning has to be performed before the first travel. Auto tuning is static; it means that the brake stays applied and is not need to remove ropes from the pulley. To do so, the parameters described in table 8 must be set.

Table 8. Motor parameters

Function	Meaning	Setting
F03	Maximum frequency 1	Depending on motor's name plate
F04	Base frequency 1	Depending on motor's name plate
F05	Rated voltage at base frequency 1	Depending on motor's name plate
F11	Overload detection level (for motor protection)	Depending on motor's name plate (P03=F11)
F12	Thermal time constant (for motor protection)	0,5min
P01	Number of poles	Depending on motor's name plate
P02	Rated capacity	Depending on motor's name plate
P03	Rated current	Depending on motor's name plate
P06	No-load current	Check point 4.1 Additional setting (No-load current)
P07	Stator resistance (%R1)	Measured by auto tuning
P08	Stator inductance (%X)	Measured by auto tuning
P12	Rated slip frequency	Measured by auto tuning

To perform an auto tuning (executed from input terminals), follow the steps listed below:

1. Is the motor correctly connected?
2. Turn on inverter mains supply.
3. Please set the functions described in table 8.
4. Set function P04 to 1 and press FUNC/DATA.
5. Enable the inverter by terminals EN1 and EN2
6. Give RUN command to the inverter from the lift controller (normally in INSPECTION mode). The main contactors will be closed and current will flow through the motor producing some acoustic noise. This procedure will take some seconds.
7. Move the lift in INSPECTION mode and check that the motor is moving smoothly. Check on menu 3 (parameter 3_02) that output current is correct. In case of closed loop (when using encoder), check on menu 4 (parameter 4_17) that encoder is counting pulses. In negative case, please check chapter 2. Encoder connection.

In case of Er7 during auto tuning, please start the procedure from the beginning.

4.1 Additional settings

If after repeating auto tuning procedure more than one time, Er7 persists, parameters P06 and P12 have to be set manually. For adjusting those parameters, follow the above methods:

- No-load current (function P06)

Typical values of the no-load current range from 30 % up to 70 % of P03. In case that no-load current cannot be measured by auto tuning (because of Er7) P03 must be set manually. For calculate no-load current you can use the formula $P06 = \sqrt{(P03)^2 - \left(\frac{P02 \cdot 1000}{1.47 \cdot F05}\right)^2}$.

Too low values in P06 will make that the motor does not have enough torque. Too high values will make that the torque oscillates (this oscillation will cause a vibration in the motor that is transmitted to the car).

- Rated slip frequency (function P12)

Rated slip frequency is very important in open loop control for a good landing accuracy. It ensures that the rotating frequency is the same regardless of the load condition of the motor.
In case that rated slip frequency cannot be measured by auto tuning (because of Er7) P12 must be set manually. For rated slip frequency you can use the formula:

$$P12 = \frac{(Synchronous\_speed(rpm) - Rated\_speed(rpm)) \times No\_Poles}{120}$$

- Slip compensation gains (functions P09 for driving mode and P11 for braking mode)

The slip frequency can be also compensated in both driving and braking mode. The experimental method for adjust these values is following. You need to test one floor level with car empty going up and down:

- If the car speed going up is smaller than the desired speed (the car doesn't reach floor level), decrease 10% the value of P10 (braking mode).

- If the carp speed going down is higher than the desired speed (the car pass floor level) decrease 10% the value of P09 (driving mode).

5. Speed selection and speed profile

By using digital inputs, the controller can drive the motor at different speeds. The available speeds are shown in table 9.

Table 9. Available speeds

/SS4 (X3)	SS2 (X2)	SS1 (X1)	Parameter selected
OFF	OFF	OFF	C08
OFF	OFF	ON	C09
OFF	ON	OFF	C10
OFF	ON	ON	C11
ON	OFF	OFF	Other than multi-frequency
ON	OFF	ON	C05
ON	ON	OFF	C06
ON	ON	ON	C07

Note that signal on X3 terminal is inverted, it means that if the input is active, it becomes OFF, in the other hand, if the input is not activated, it becomes ON. For additional information please refer to User's manual MEH278b.

5.1 Speed profile in open loop

A complete travel in NORMAL operation is shown in figure 12. As it can be observed, all the signals and related parameters appear on this figure.

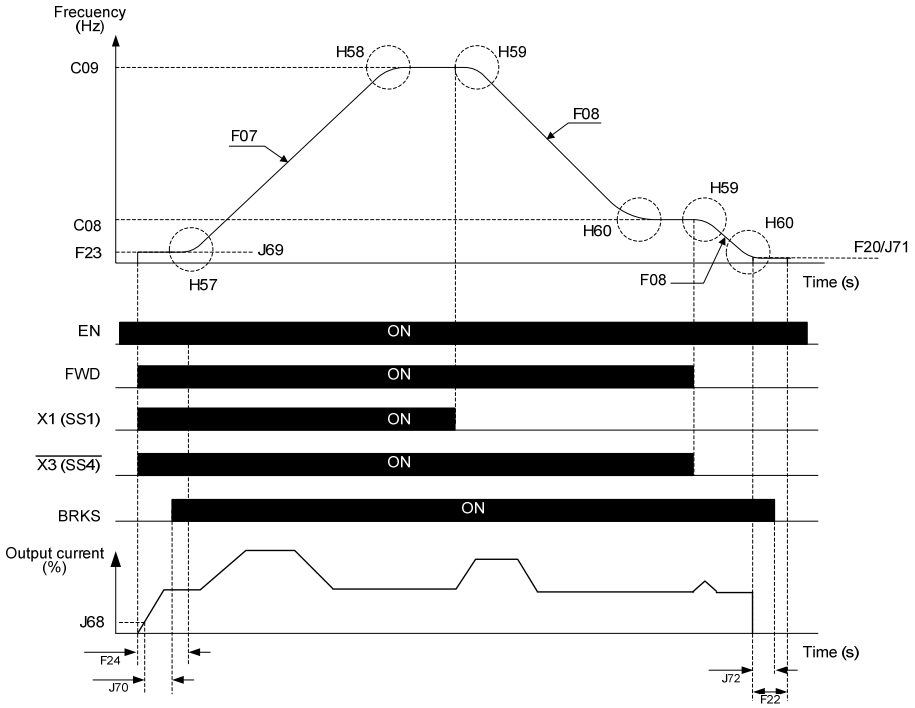

Figure 12. Complete travel in NORMAL operation (open loop)

In case of INSPECTION operation, the only difference is that there is no creep speed (C08) and motor is accelerating to C10.

5.2 Speed profile in closed loop

A complete travel in NORMAL operation is shown in figure 13. As it can be observed, all the signals and related parameters appear on this figure.

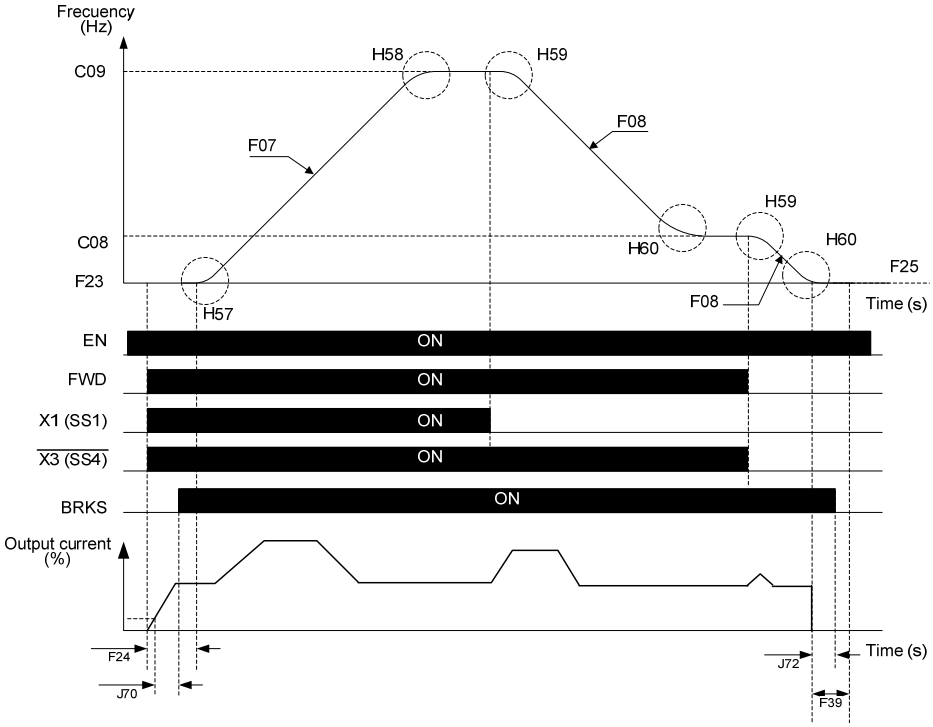

Figure 13. Complete travel in NORMAL operation (closed loop)

In case of INSPECTION operation, the only difference is that there is no creep speed (C08) and motor is accelerating to C10.

6. Special functions

6.1 Rescue operation (deliverance operation)

By means of FRENIC-MEGA, it is possible to set a “Deliverance Operation” for rescuing the load in vertical applications, minimizing the auxiliary power supply size by choosing the best direction for the rescue, according to the available inverter input power.

In order to have rescue operation available following conditions must be fulfilled:

- DC voltage must be supplied from batteries (or UPS) to the main circuit (L1/R-L3/T or L2/S-L3/T). The voltage level needed differs depending on the operation speed and load.
- 220 VAC must be supplied to auxiliary power supply (R0-T0).
- BATRY function (programmed in terminal X5) must be activated.
- Forward (FWD) or Reverse (REV) direction must be given.
- Speed needs to be selected.

This function calculates the best direction to perform the movement (FWD or REV), when a vertical load with a counterweight has to be moved and the requirements about the input power are very restrictive (i.e., supplying the inverter by means of a UPS system or batteries).

Calculation will be performed at the first RUN command after Power up and BATRY input activation. Once the best direction is decided, this result will be used until inverter is shut down, BATRY input is deactivated or any alarm arises.

Table 10. Parameter to enable soft rescue operation

Parameter	Name	Setting for TP-G1-J1 keypad	Default
L01	Deliverance Operation: Input power detection level	From 1 to 200 % (of the inverter rated power)	100%
L02	Deliverance Operation: Direction Calculation Setup	Bit 0: Deliverance operation (0:Disabled, 1:Enabled) Bit 1: Operation when Input Power Detection level Reached (0:Disabled, 1:Enabled) Bit 2: Always test both directions (0:Disabled, 1:Enabled)	00000001
L03	Deliverance Operation: Direction Calculation Delay Timer	From 0.00 s to 1.00 s	0.30 s

In figure 14, an example of rescue operation when inverter is in default setting is shown. In this case, inverter drives the motor in FWD direction, after L03 times is elapsed, L01 level is reach. At this point inverter decelerates the motor to stop condition, and automatically changes direction to REV. Because L01 level is not reached in REV direction, rescue operation is finished.

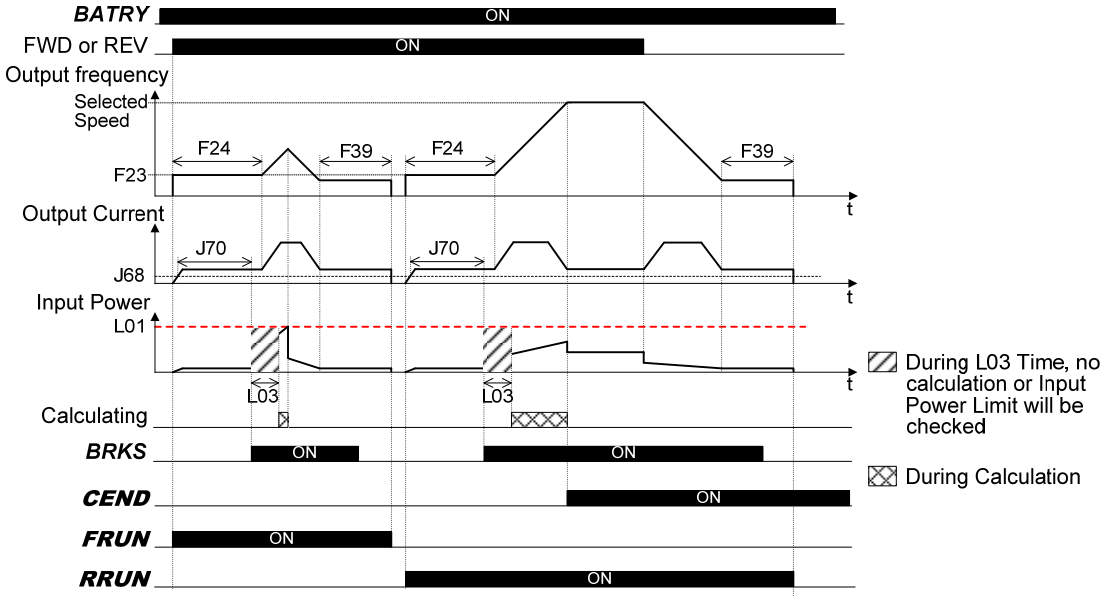

Figure 14. Example of rescue operation when L01 is reached in FWD direction

If L01 is reached in both directions, then inverter will stop without performing rescue operation. For additional information about different modes of “deliverance operation” please refer to specifications document.

6.2 Soft start

FRENIC-MEGA has the function to soft start the lift cabin. This function may be used to improve the start in a lifts with high friction (back-pack style). In order to have this function active, the parameter shown in table 11 has to be set.

Table 11. Parameter to enable soft start function

Parameter	Name	Default	Recommend (open loop)	Recommend (close loop)
F23	Starting frequency	0.50 Hz	0.20 Hz	0.00 Hz
F24	Starting frequency (holding time)	0.70 s	0.50 s	0.70 s
L04	Soft Start operation: (Frequency)	00.0 Hz	0.60 Hz	0.60 Hz
L05	Soft Start operation (Time)	0.00 s	0.50 s	0.50 s

The soft start operation will consist into reaching the frequency specified in L04, during the time in L05, after the Starting Frequency (F23 and F24), following the active acceleration/deceleration ramps and S-curves settings. Following, in Figure 14 and 15, the behaviours in open loop or closed loop are depicted.

6.3 Closed loop

When a motor is controlled in a closed loop (with encoder), FRENIC-MEGA has different sets of ASR (Automatic Speed Loop Regulator) gains in order to adjust the comfort in different parts of the profile.

When FRENIC-MEGA is driving motor (when car is moving) in order to adjust comfort on the lift, motor parameters can be automatically changed during operation, depending on the starting procedure or the speed. This procedure will take certain parameters of different motor maps and will switch them. For additional information please check table 12 13 and figure 17.

Table 12. Parameter to enable Motor Parameters Automatic change

Parameter	Name	Setting	Default	TP-G1-J1	TP-E1U
d99	Reserved	0 to 63	0	Bit 5 = 1 (Active)	32

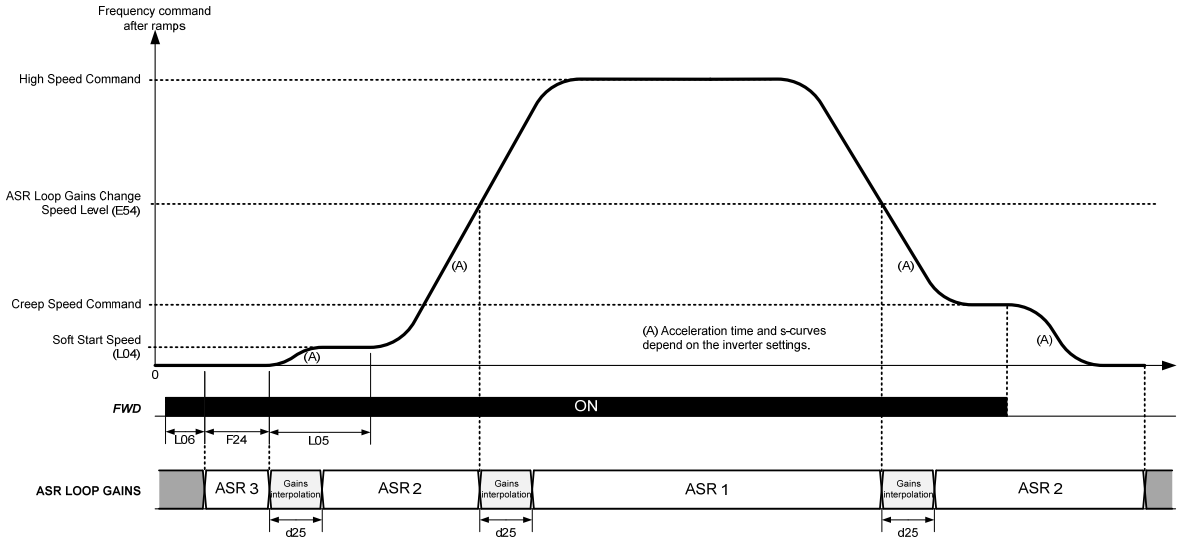

Figure 17. ASR Loop Gains automatic change example

Table 13. Parameter ASR Loop Gains automatic change

Parameter	Name	Recommended Setting	Default
Zero Speed / Anti-RollBack			
b45	Speed Control 3 P (Gain)	10.0	10.0
b46	Speed Control 3 I (Integral time)	0.100 s	0.100 s
Low Speed			
A45	Speed Control 2 P (Gain)	10.0	10.0
A46	Speed Control 2 I (Integral time)	0.100 s	0.100 s
High Speed			
d03	Speed Control 1 P (Gain)	10.0	10.0
d04	Speed Control 1 I (Integral time)	0.100 s	0.100 s
Gains switching			
E54	Frequency Detection 3 (Level)	E54 = 10.00 > C08 (Creep speed)	50.0 Hz
d25	ASR Switching Time	0.100 s	0.000 s

6.4 Motor contactors control function (SW52-3 and SW52-4)

The motor contactors control has been added to FRENIC MEGA, by means of the new functions for the digital output terminals, SW52-3 and SW52-4.

In addition to the two digital output functions, L06 “MC Control: Startup Delay Time” and L07 “MC Control: MC OFF Delay Time” have been added. Please refer to the information below:

- **L06**, “MC Control: Startup Delay Time”: This timer has been added in order to delay the main circuit gate activation from the Run command activation. In this way, the user is allowed to compensate the mechanical delay on the contactors, before starting to inject current to the motor.

- **L07**, “MC Control: MC OFF Delay Time”: This timer has been added in order to delay the opening procedure of the contactors. This will allow the motor demagnetization and voltage drop to be completed before the contactors are opened, avoiding current peaks.

Table 14. L06 and L07 function code attributes

Parameter	Name	Setting	Default	Recommended
L06	MC Control: (Startup Delay Time)	0.00 to 10.00 s.	0.00 s.	0.10 s.
L07	MC Control: (MC OFF Delay Time)	0.00 to 10.00 s.	0.00 s.	0.10 s.

Note: Even no SW52-3 or SW52-4 output signals have been selected, if L06 ≠ 0, the inverter will apply the delay time in L06 between the Run Command switching ON and opening of main circuit output gate.

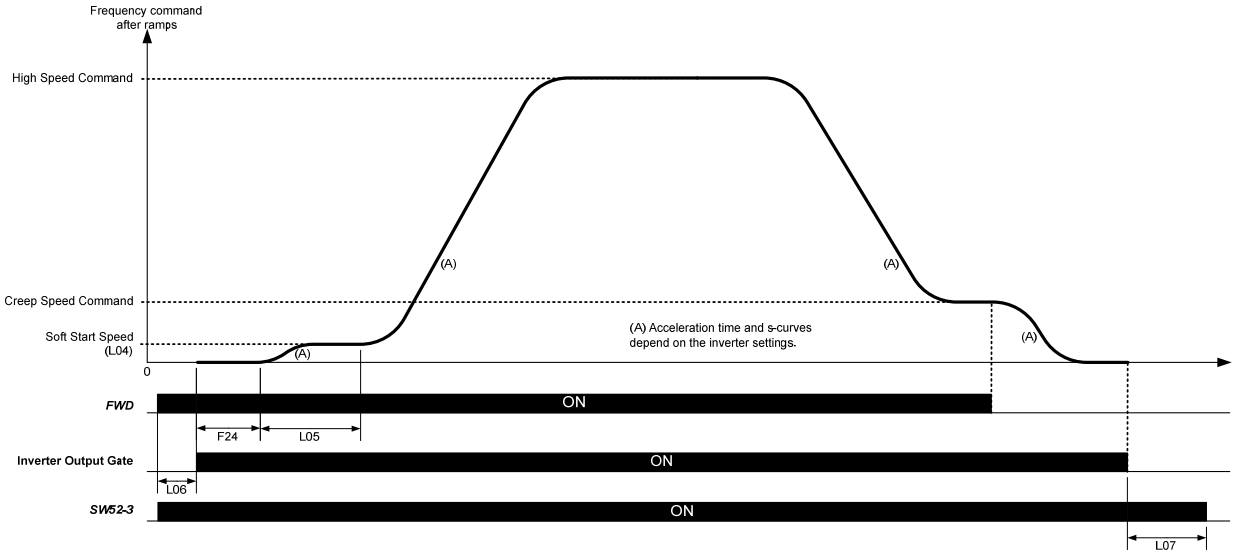

Figure 18. Motor Contactor Control Behavior when function SW52-3 is used

6.5 Motor Contactors check function

This function allows inverter to check the state of the motor contactors. To do so, please set any input with the value 82 which corresponds to the function Contactor Check signal (CS-MC). This input function is available as follow.

If this value is different from the SW52-3 or SW52-4 output signals during a time longer than the value in L08 (“MC Check Time”), a procedure alarm (Er6) will arise. L08 value is used to compensate the mechanical delay of the contactors. The function code attributes for L08 are:

Table 19. L08 Function code attributes

Parameter	Name	Setting	Default	Recommended
L08	MC Check Time	0.00 to 10.00 s.	0.00 s.	1.00 s.

6.6 Motor Brake check function

A brake check input function has been added as well, similar to the Contactor check function. In this case, this function can be assigned to any input is Brake check signal (BRKE) corresponding to the value 83.

As in the contactor check signal, it’s possible to set a delay timer because of the mechanical delay in the brake system. If the BRKS output signal and the BRKE input signal are different during a time longer than the specified, Er6 alarm will arise. In case of brake check signal, the delay time value is in the L09 function code:

Table 21. L08 Function code attributes

Parameter	Name	Setting	Default	Recommended
L09	Brake Check Time	0.00 to 10.00 s.	0.00 s.	1.00 s.

Note: If several input terminals have been defined with the BRKE function, all of them should be equal to the output contactors signals within the time in L09. Otherwise, an Er6 alarm would occur.

7. Parameters list

F codes: Fundamental functions

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
F00	Data Protection	0: Disable both data protection and digital reference protection 1: Enable data protection and disable digital reference protection 2: Disable data protection and enable digital reference protection 3: Enable both data protection and digital reference protection	0	0
F01	Frequency Command 1	0: ⏶ / ⏷ keys on keypad 1: Voltage input to terminal [12] (-10 to +10 VDC) 2: Current input to terminal [C1] (4 to 20 mA DC) 5: Voltage input to terminal [V2] (0 to 10 VDC	2	2
F02	Operation Method	0: RUN/STOP keys on keypad (Motor rotational direction specified by terminal command ***FWD***/***REV***) 1: Terminal command ***FWD*** or ***REV*** 2: RUN/STOP keys on keypad (forward) 3: RUN/STOP keys on keypad (reverse)	1	1
F03	Maximum Frequency 1	25.0 to 500.0 Hz	50.0	50.0
F04	Base Frequency 1	25.0 to 500.0 Hz	50.0	50.0
F05	Rated Voltage at Base Frequency 1	0: Output a voltage in proportion to input voltage 160 to 500 V: Output an AVR-controlled voltage (for 400 V class series)	400	400
F06	Maximum Output Voltage 1	160 to 500 V: Output an AVR-controlled voltage (for 400 V class series)	400	400
F07	Acceleration Time 1	0.00 to 6000 s	1.80	1.80
F08	Deceleration Time 1	Note: Entering 0.00 cancels the acceleration time, requiring external soft-start.	1.00	1.00
F09	Torque Boost 1	0.0% to 20.0% (percentage with respect to "Rated Voltage at Base Frequency 1")	*1	0.0
F10	Electronic Thermal Overload Protection for Motor 1 (Select motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan	1	1
F11	(Overload detection level)	0.00: Disable 1% to 135% of the rated current (allowable continuous drive current) of the motor	*2	*2
F12	(Thermal time constant)	0.5 to 75.0 min	0.5	0.5
F20	DC Braking 1 (Braking starting frequency)	0.0 to 60.0 Hz	0.2	0.0
F21	(Braking level)	0% to 100% (HD mode), 0% to 80% (LD mode)	50	0
F22	(Braking time)	0.00 (Disable); 0.01 to 30.00 s	1.00	0.00
F23	Starting Frequency 1	0.0 to 60.0 Hz	0.50	0.00
F24	(Holding time)	0.00 to 10.00 s	0.70	0.70
F25	Stop Frequency	0.0 to 60.0 Hz	0.2	0.0
F26	Motor Sound (Carrier frequency)	0.75 to 16 kHz (HD-mode inverters with 55 kW or below and LD-mode ones with 18.5 kW or below)	15 kHz	15 kHz
F38	Stop Frequency (Detection mode)	0: Detected speed 1: Commanded speed	1	1
F39	(Holding Time)	0.00 to 10.00 s	0.00	1.00
F42	Drive Control Selection 1	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 6: Vector control with speed sensor	1	6

*1 It depends on the inverter's capacity
*2 it depends on the motor's capacity

E codes: Extension Terminal Functions

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
E01	Terminal [X1] Function	Selecting function code data assigns the corresponding function to terminals [X1] to [X7] as listed below. 0 to 77 (1000 to 1007) Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal. 0 (1000): Select multi-frequency (0 to 1 steps) (SS1) 1 (1001): Select multi-frequency (0 to 3 steps) (SS2) 2 (1002): Select multi-frequency (0 to 7 steps) (SS4 3 (1003): Select multi-frequency (0 to 15 steps) (SS8) 5 (1005): Select ACC/DEC time (4 steps) (RT2) 8 (1008): Reset alarm (RST) 59: (1059) BATRY 82: (1082) Contactor Check Signal (CS-MC) 83: (1083) Brake Check Signal (BRKE)	0	0
E02	Terminal [X2] Function		1	1
E03	Terminal [X3] Function		1002	1002
E04	Terminal [X4] Function		3	3
E05	Terminal [X5] Function		59	59
E06	Terminal [X6] Function		5	5
E07	Terminal [X7] Function		8	8
E20	Terminal [Y1] Function	Selecting function code data assigns the corresponding function to terminals [Y1] to [Y5A/C] and [30A/B/C] as listed below. 0 to 105 (1000 to 1105). Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal. 0 (1000): Inverter running (RUN) 1 (1001): Frequency (speed) arrival signal (FAR) 2 (1002): Frequency (speed) detected (FDT) 7 (1007): Motor overload early warning (OL) 57 (1057): Brake signal (BRKS) 74 (1074): MC Control 1 (SW52-3) 75 (1075): MC Control 2 (SW52-4) 99 (1099): Alarm output (for any alarm) (ALM)	0	0
E21	Terminal [Y2] Function		1	1
E22	Terminal [Y3] Function		2	2
E23	Terminal [Y4] Function		7	7
E24	Terminal [Y5A/C] Function		57	57
E27	Terminal [30A/B/C] Function		99	99
E46	LCD Monitor (Language selection)	1: English 2: Germany 3: French 4: Spanish 5: Italian	5	5
E54	Frequency Detection 3 (Level)		50.0	10.0
E98	Terminal [FWD] Function	Selecting function code data assigns the corresponding function to terminals [FWD] and [REV] as listed below. 0 to 99 (1000 to 1099) Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal.	98	98
E99	Terminal [REV] Function		99	99

C codes: Control Functions of Frequency

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
C05	Multi-frequency 1	0.00 to 500.00 Hz	0.00	0.00
C06	2		0.00	0.00
C07	3		0.00	0.00
C08	4		5.00	5.00
C09	5		50.00	50.00
C10	6		25.00	25.00
C11	7		0.00	0.00

P codes: Motor 1 Parameters

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
P01	Motor 1 (No. of poles)	2 to 22 poles	4	4
P02	(Rated capacity)	0.01 to 1000 kW (when P99 = 0, 2, 3 or 4) 0.01 to 1000 HP (when P99 = 1)	*1	*1
P03	(Rated current)	0.00 to 2000 A	*1	*1
P04	(Auto-tuning)	0: Disable 1: Tune while the motor stops. (%R1, %X and rated slip frequency)	0	0
P06	(No-load current)	0.00 to 2000 A	*1	*1
P07	(%R1)	0.00% to 50.00%	*2	*2
P08	(%X)	0.00% to 50.00%	*2	*2
P09	(Slip compensation gain for driving)	0.0% to 200.0%	100.0	100.0
P10	(Slip compensation response time)	0.01 to 10.00 s	0.12	0.12
P11	(Slip compensation gain for braking)	0.0% to 200.0%	100.0	100.0
P12	(Rated slip frequency)	0.00 to 15.00 Hz	*2	*2

*1 It depends on the inverter's capacity
*2 it depends on auto tuning

H codes: High Performance Functions

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
H03	Data Initialization	0: Disable initialization 1: Initialize all function code data to the factory defaults	0	0
H04	Auto-reset (Times)	0: Disable; 1 to 10	0	0
H05	(Reset interval)	0.5 to 20.0 s	5.0	5.0
H06	Cooling Fan ON/OFF Control	0.0: Enable (Auto ON/OFF, minimum running time set to zero) 0.5 to 10.0: Enable (Auto ON/OFF. Setting value as minimum running time) 999: Disable (Fan always in operation)	1.0	1.0
H07	Acceleration/Deceleration Pattern	0: Linear 1: S-curve (Weak) 2: S-curve (Arbitrary, according to H57 to H60 data) 3: Curvilinear	2	2
H12	Instantaneous Overcurrent Limiting (Mode selection)	0: Disable 1: Enable	1	1
H26	Thermistor (for motor) (Mode selection)	0: Disable 1: PTC (The inverter immediately trips with □-H displayed.) 2: PTC (The inverter issues output signal ***THM*** and continues to run.) 3: NTC (When connected)	0	0
H27	(Level)	0.00 to 5.00 V	0.35	0.35
H57	1st S-curve acceleration range (Leading edge)	0% to 100%	25	25
H58	2nd S-curve acceleration range (Trailing edge)	0% to 100%	25	25
H59	1st S-curve deceleration range (Leading edge)	0% to 100%	25	25
H60	2nd S-curve deceleration range (Trailing edge)	0% to 100%	25	25
H96	STOP key priority / Start check function	0: STOP key priority OFF / Start check OFF 1: STOP key priority ON / Start check OFF 2: STOP key priority OFF / Start check ON 3: STOP key priority ON / Start check ON	2	2
H97	Clear Alarm Data	0: Disable 1: Enable (Setting "1" clears alarm data and then returns to "0.")	0	0

A codes: Motor 2 Parameters

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
A42	Motor/Parameter Switching 2 (Mode selection)	0: Motor (Switch to the 2nd motor) 1: Parameter (Switch to particular A codes)	0	1
A45	Speed Control 2 (P gain)	0.1 to 200.0 times	10.0	10.0
A46	(I Integral time)	0.001 to 9.999 s	0.100	0.100

b codes: Motor 3 Parameters

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
b42	Motor/Parameter Switching 3 (Mode selection)	0: Motor (Switch to the 3rd motor) 1: Parameter (Switch to particular b codes)	0	1
b45	Speed Control 3 (P gain)	0.1 to 200.0 times	10.0	10.0
b46	(I Integral time)	0.001 to 9.999 s	0.100	0.100

J codes: Application Functions 1

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
J68	Brake Signal (Brake-OFF current)	0% to 300%	1	1
J69	(Brake-OFF frequency/speed)	0.0 to 25.0 Hz	0.1	0.0
J70	(Brake-OFF timer)	0.0 to 5.0 s	0.2	0.2
J71	(Brake-ON frequency/speed)	0.0 to 25.0 Hz	0.2	0.2
J72	(Brake-ON timer)	0.0 to 5.0 s	0.0	0.2
J95	(Brake-OFF torque)	0% to 300%	100	0
J96	(Speed selection)	0: Detected speed 1: Commanded speed	1	1

d codes: Application Functions 2

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
d03	Speed Control 1 (P gain)	0.1 to 200.0 times	10.0	10.0
d04	(I Integral time)	0.001 to 9.999 s	0.100	0.100
d14	Feedback Input (Pulse input property)	0: Pulse train sign/Pulse train input 1: Forward rotation pulse/Reverse rotation pulse 2: A/B phase with 90 degree phase shift	2	2
d15	(Encoder pulse resolution)	0014 to EA60 (hex.) (20 to 60000 pulses)	0400 (1024)	0400 (1024)
d21	Speed Agreement/PG Error (Hysteresis width)	0.0% to 50.0%	10.0	10.0
d22	(Detection timer)	0.00 to 10.00 s	0.50	0.50
d25	ASR Switching Time	0.000 to 1.000 s	0.000	0.100
d99	Reserved	d99 Bit5=1 (Active) for TP-G1-J1 keypad: ENABLE Motor param. Automatic change & Anti-RollBack d99 = 32 for TP-E1U keypad: ENABLE Motor param. Automatic change & Anti-RollBack	0	0

L codes: Deliverance Operations

Code	Name	Data setting range	Default setting (for open loop)	Recommended setting for closed loop
L01	Input power detection level	From 1 to 200 % (of the inverter rated power)	100%	100%
L02	Direction Calculation Setup	TP-G1-J1 keypad Bit 0: Deliverance operation (0:Disabled, 1:Enabled) Bit 1: Operation when Input Power Detect. level Reached (0:Disabled, 1:Enabled) Bit 2: Always test both directions (0:Disabled, 1:Enabled)	001	001
L03	Direction Calculation Delay Timer	From 0.00 s to 1.00 s	0.30 s	0.30 s
L04	Soft start operation: Frequency	0.0 to 60.0 Hz	0.0 Hz	0.0 Hz
L05	Soft start operation: Time	0.00 to 10.00 s	0.00 s	0.00 s
L06	MC Control: Startup Delay Time	0.00 to 10.00 s	0.00 s	0.00 s
L07	MC Control: MC OFF Delay Time	0.00 to 100.00 s	0.00 s	0.00 s
L08	MC Check Time	0.00 to 10.00 s	0.00 s	0.00 s
L09	Brake Check Time	0.00 to 10.00 s	0.00 s	0.00 s

8. Troubleshooting

⚠WARNING

If any of the protective functions has been activated, first remove the cause. Then, after checking that the all run commands are set to OFF, release the alarm. If the alarm is released while any run commands are set to ON, the inverter may supply the power to the motor, running the motor.

Injury may occur.

- Even though the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V, and W.
- Turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P (+) and N (-) has dropped to the safe level (+25 VDC or below).

Electric shock may occur.

Alarm code	Alarm name	Alarm description
0C 1	Overcurrent protection during acceleration	Excessive output current due to: - Excessive motor load. - Acceleration (deceleration) too fast. - Short circuit in the output circuit. - Ground fault (this protection is effective only during start up). - Brake doesn't open
0C2	Overcurrent protection during deceleration	
0C3	Overcurrent protection at constant speed	
0U 1	Overvoltage protection during acceleration	Voltage in the DC link too high (400 V for 200 V class inverters; 800 V for 400 V class inverters) due to: - Deceleration too fast. - The motor is regenerating energy and there is no braking resistor connected to the inverter or it is defective. This protection may not protect the case where the supply voltage is excessive
0U2	Overvoltage protection during deceleration	
0U3	Overvoltage protection at constant speed	
LU	Undervoltage protection	Voltage in the DC link too low (200 V for 200 V class inverters; 400 V for 400 V class inverters). - Supply voltage too low. - Main supply failure during RUN mode.
L in	Input phase loss protection	Input phase loss. If the inverter load is low or a DC reactor is installed the event of an input phase loss may be not detected.
0PL	Output phase lost protection	An output phase of the inverter is in open circuit.
0H 1	Overheat protection	Excessive heat sink temperature due to: - Inverter fan is not working. - The inverter is overloaded.
dbH	External braking resistor overheat	Overheating of the external braking resistor
0LU	Overload protection	IGBT internal temperature calculated from the output current and from the temperature inside the inverter is over the preset value.
0H2	External alarm input	A digital input is programmed with the function THR (9) and has been deactivated.
0L 1	Electronic thermal overload motor 1	The inverter is protecting the motor in accordance with the electronic thermal overload protection setting: - F10 (A06, b06, r06) =1 is for general purpose motors. - F10 (A06, b06, r06) =2 is for inverter motors. - F11 (A07, b07, r07) defines the operation level (current level). - F12 (A08, b08, r08) defines the thermal time constant. F functions are for motor 1, A functions are for motor 2, b functions are for motor 3 and r functions are for motor 4.
0L2	Electronic thermal overload motor 2	
0H4	PTC thermistor	The thermistor input has stopped the inverter to protect the motor. The thermistor has to be connected between terminals [C1] and [11]. Also the slide switch has to be set to the correct position and functions H26 (enable) and H27 (level) have to be set.
0S	Overspeed	The output frequency has exceeded 200 Hz. Please, check encoder wiring and fixation.
Er 1	Memory error detection	Memory error has been detected during power up.
Er2	Keypad communications error detection	The inverter has detected a communications error with the keypad (standard keypad or multifunction keypad).
Er3	CPU error detection	Inverter has detected a CPU error or LSI error caused by noise or some other factors.
Er4	Option communications error detection	Inverter has detected a communications error with the option card.
Er5	Option error detection	The option card has detected an error.
Er6	Procedure error	Operation method has been changed (REM/LOC or LOC/REM) while RUN command was active.
ECF	Enable circuit failure	Terminal EN1 and/or EN2 are not correctly wired. This alarm can be only reset by switching off inverter power supply.

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